Grayhill INC 561 Hillgrove Ave. LaGrange, Illinois 60525	**Engineering Specification**	Date : 10/26/2011 Revision Level: B
	3JUM1330-1	
	User Manual, VDC, CANopen	Written By: BMM

Applicable Products:	Grayhill Vehicle Display controllers (VDC) with CANopen		
REVISION	**DESCRIPTION**	**CHECKED**	**APPROVED**
A	Original	RMO 5-3-2011	RAL 5-3-2011
B	Corrected TPDO param. RTR not supported.	RMO 10-26-2011	RAL 10-26-2011

This form is used to describe the software components or a new product or feature. This form is provided as a base to describe construction of a software module(s). Sections may be added at the discretion of the design engineer to detail more functionality of the software components.

1. Scope

This document describes the implementation of CANopen on the Grayhill VDC.

2. Relevant Documents

- o CiA Draft Standard 301, Application Layer and Communication Profile
- o CiA Draft Standard 305, Layer Setting Services (LSS) and Protocols

3. Product Validation –

- Compliance shall be per CiA conformance test tool version 2.0.
- Grayhill CANopen vendor ID – 0x0307

4. Hardware Description

The Grayhill standard VDC have inputs that include: five buttons, a rotary encoder with an optional push select that behaves as a sixth button, and an optional eight directional joystick. The only output the VDC has is the backlight intensity of the entire module. The object dictionary entries shall be the same for all options. The bits associated with the unused options shall read as zero.

4.1. Input

Inputs will correspond to a bit within the corresponding Object Dictionary (OD) entry. A pressed/released button shall have a value of 1/0 respectively.

These inputs shall be transmitted using the default TPDO 1 as defined in CiA 301. The user is free to change the COB-ID.

4.2. Outputs

The backlight brightness is an analog value mapped to an eight-bit OD entry that can be controlled by the RPDO1 or using the Service Data Object (SDO).

5. Object Dictionary (OD)

All of the mandatory entries of the Object Dictionary (OD) as defined in CiA 301 and 305 shall be implemented. The following is the list of the Object Dictionary entries that are implemented.

5.1. 1000h – Device Type

Value = 0x00:

This value indicates that this device is Manufacturer Specific and is not base on a CiA standard.

5.2. 1001h – Error Register

The use of the this register is not yet defined but is mandatory to be compliant

5.3. 1008h – Manufacturer Device Name

This is a visible string constant and gives the name of the device.

5.4. 1009h – Manufacturer Hardware Version

This is a visible string constant and describes the version of the hardware

5.5. 100Ah – Manufacturer Software Version

This is a visible string constant and describes the version of the software

5.6. 1010h – Store Parameters

This entry will be used to store parameters pertaining to the communication device specific parameters as defined by CiA v301. Not all Manufacturer Specific parameters are stored. Refer to the Manufacturer Specific OD entries for the parameters that are stored.

5.7. 1011h – Load Parameters

This entry is used to load the parameters that were stored according to Sec. 5.6.

5.8. 1017h* – Producer Heartbeat Time

5.9. 1018h – Identity Object

Sub Entry:

- 00h – Number of Subentries. (4)
- 01h – Vendor ID 307h
- 02h – Product Code 334Ah (ASCII 3J)
- 03h – Revision Number
- 04h – Serial Number

5.10. 1400h* – 1st Receive PDO Communication Parameter

Sub Entry:

- 00h – Number of Subentries. Value = 3
- 01h* - COBID (Default: 200h + NODEID)
- 02h – Transmission Type

5.11. 1600h – 1st Receive PDO Mapping

Sub Entry:
- 00h – Number of subentries. Value = 1
- 01h – Backlight brightness mapping parameter. Value = 20100108h

5.12. 1800h* – 1st Transmit PDO Communication Parameter

Sub Entry:
- 00h – Number of Subentries. Value = 5
- 01h* - COBID (Default: 180h + NODEID+ 2^30) RTR not supported
- 02h – Transmission Type
- 03h* – Inhibit Time (Default: 0)
- 04h – Reserved, not used
- 05h* – Event Timer. (Default: 0)

5.13. 1A00h – 1st Transmit PDO Mapping

Sub Entry:
- 00h – Number of Subentries. Value = 3
- 01h - Encoder Mapping. Value = 20000110h
- 02h – Button Mapping. Value = 20010108h
- 03h – Joystick Mapping. Value = 20020108h

5.14. 2000h* – Encoder Information.

Sub Entry:
- 00h – Number of Subentries
- 01h – Current Value:16 bit signed number indicating the current value of the encoder
- 02h – Direction: 8 bit unsigned indicating the direction of the turn
  1. Clockwise
  2. Counter Clockwise
- 03h* – Rollover: 8 bit unsigned value used to enable or disable the Current Value from rolling over.
  - 0 – Disabled
  - 1 - Enabled
- 04h – Revolutions: 16 bit signed integer holding the revolutions of the encoder.
- 05h* – Top Value: 16 bit unsigned value that holds the top most value the Current Value counts up to.

Turing the encoder clockwise will increase the value.

5.15. 2001h – Button Information.

Sub Entry:
- 00h – Number of Subentries
- 01h – 8 bit unsigned. The first five bits correspond to buttons 1 through 5. The sixth bit corresponds to the encoder select pushbutton if capable.

5.16. 2002h – Joystick Information

Sub Entry:

- 00h – Number of Subentries
- 01h – 8 bit unsigned. Bits 0 through 3 correspond to joystick up, down, left, right respectively. Directions Up/Down are mutually exclusive. Directions Left/Right are mutually exclusive. Moving the joystick up and to the left will set both bit 0 and bit 3.

5.17. 2010h* – Backlight Brightness

Sub Entry:

- 00h – Number of entries
- 01h* – 8 bit unsigned value controlling the brightness of the backlights
  - Valid Range from 0 (off) to 255 (full illumination)
- 02h* – 8 bit unsigned value used as a scalar value for the full brightness. This value ranges from 64 (40h) to 255 (FFh) and can be though of as the ratio of this number over 255. Ex. if 100% on is too bright (255/255) a value of 191 can be entered in this OD entry to scale the full range down to 75% (191/255).

6. Process Data Objects (PDO's)

6.1. RPDO

One RPDO exist controlling the brightness of the backlights.

6.1.1. RPDO1

OD 2010sub01 is mapped to this RPDO and will be used to receive the analog input used for controlling the backlight brightness.

6.2. TPDO

One TPDO will be used to transmit the VDC information. Remote Transmit Request (RTR) will not be supported on the TPDO

6.2.1. TPDO1

This PDO will transmit OD 2000sub01, 2001sub01 and 2002sub01 in a four byte CAN Object (COB) using the default COBID for TPDO1.

6.3. Dynamic PDO Mapping

No Dynamic Mapping shall be used.

7. Layer Setting Services

The Grayhill keypads shall support the following baud rates.

- 10kbps

- o 20kbps
- o 50kbps
- o 100kbps
- o 125kbps
- o 250kbps (Default)
- o 500kbps
- o 1000kbps

Using the LSS, the device shall have the ability to change the node ID and the baud according to CiA v305

* Value is stored in non-volatile memory when the Store Parameters is performed for the Manufacturer Specific entries.

8. Grayhill CAN Open Configuration Variables

Custom versions of our 3J product feature a customer-specific part number and allow factory configuration of numerous parameters. A description of parameters Grayhill can configure for custom part numbers appears below in table 1.

Table 1 – Configurable parameters

Field Name	Parameter Type	Size (bytes)	Range	Default Value	Comments
Add customer part number on label	YES/NO			NO	
Default Node ID	INTEGER	1		0x0A	
Heartbeat period	INTEGER	1		0	
Receive PDO Comm Params					
COBID	INTEGER	2		0x020A	
Transmit PDO Comm Param					
COBID	INTEGER	2		0x4000018A	PDO mapping not supported + 0x180 + COBID. RTR not supported
Inhibit Time	INTEGER	2		0	
Event Timer	INTEGER	2		0	
Encoder Variables					
Rollover	BOOLEAN	1	0..1	0	When enabled will roll over from TOP to zero
TOP	INTEGER	2	0..65535		
Backlight Brightness					Equal to high byte of the value multipled by the scalar.
Value	INTEGER	1	0..255	0	

Scalar	INTEGER	1	64..255	255	